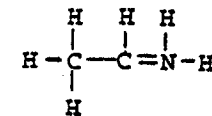


八十七學年度 原子科學 系(所) 乙 組碩士班研究生入學考試
 有機化學 科號 4203 共 5 頁第 1 頁 *請在試卷【答案卷】內作答
 科目 _____

I. Multiple Choice (3% of each) (60%)

1. The formal charge on nitrogen in the compound below is _____.



- A. +2 B. +1 C. 0 D. -1 E. 2

2. Consider the interaction of two hydrogen 1s atomic orbitals of the same phase. Which of the statements below is an incorrect description of this interaction?

- A. A sigma bonding molecular orbital is formed.
 B. The molecular orbital formed is lower in energy than a hydrogen 1s atomic orbital.
 C. The molecular orbital formed has a node between the atoms.
 D. The molecular orbital formed is cylindrically symmetric.
 E. A maximum of two electrons may occupy the molecular orbital formed.

3. Which of the following correctly lists the conformations of cyclohexane in order of increasing energy?

- A. chair < boat < twist < half-chair
 B. half-chair < boat < twist < chair
 C. chair < twist < half-chair < boat
 D. chair < twist < boat < half-chair
 E. half-chair < twist < boat < chair

4. A mixture of equal amounts of two enantiomers _____.

- A. is called a racemic mixture
 B. is optically inactive
 C. implies that the enantiomers are meso forms
 D. both a and b
 E. none of the above

5. S_N1 reactions usually proceed with:

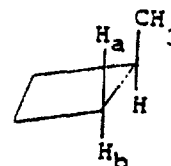
- A. equal amounts of inversion and retention at the center undergoing substitution.
 B. slightly more inversion than retention at the center undergoing substitution.
 C. slightly more retention than inversion at the center undergoing substitution.
 D. complete inversion at the center undergoing substitution.
 E. complete retention at the center undergoing substitution.

6. How many elements of unsaturation are implied by the molecular formula C₅H₅NO₂?

- A. 0 B. 1 C. 2 D. 3 E. 4 F. 5

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7. Both (E)- and (Z)-3-hexene can be subjected to a hydroboration-oxidation sequence. How are the products from these two reactions related to each other?
- The (E)- and (Z)-isomers generate the same products in exactly the same amounts.
 - The (E)- and (Z)-isomers generate the same products but in differing amounts.
 - The products of the two isomers are related as diastereomers.
 - The products of the two isomers are related as enantiomers.
 - The products of the two isomers are related as structural isomers.
8. Which of the following alkyl halides would be suitable to use when forming a Grignard reagent?
- $\text{H}_2\text{NCH}_2\text{CH}_2\text{Br}$
 - $(\text{CH}_3)_2\text{NCH}_2\text{CH}_2\text{Br}$
 - $\text{CH}_3\text{COCH}_2\text{CH}_2\text{Br}$
 - $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CN}$
 - all of the above
9. The reaction of PhMgBr with $\text{CH}_3\text{COCH}_2\text{CH}_3$ gives:
- an achiral product
 - a mixture of diastereomers.
 - the racemate of a chiral product.
 - a single enantiomer.
10. Absorption of what type electromagnetic radiation results in transitions among allowed nuclear spin states?
- X-rays
 - radio waves
 - microwaves
 - ultraviolet light
 - infrared light
11. When a high energy electron impacts molecule M in the ionization chamber, what type of species is initially produced?
- anion
 - cation
 - radical
 - radical anion
 - radical cation
12. The protons marked H_a and H_b in the molecule below are _____



- chemically equivalent
- enantiotopic
- diastereotopic
- endotopic
- none of the above

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- 科目 _____ 科號 _____ 共 _____ 頁第 _____ 頁 *請在試卷【答案卷】內作答
- What results when *cis*-2-butene is subjected to the following reaction sequence: (1) $\text{Cl}_2, \text{H}_2\text{O}$, (2) NaOH , (3) H_3O^+ ?
 - a meso epoxide
 - a 1:1 mixture of enantiomeric epoxides
 - a meso diol
 - a 1:1 mixture of enantiomeric diols
 - 2-butanol
 - In the reduction of alkynes using sodium in liquid ammonia, which of the species below is not believed to be an intermediate in the commonly accepted mechanism?
 - vinyl anion
 - vinyl radical
 - radical anion
 - vinyl cation
 - Which of the following compounds is the most reactive dienophile in a Diels-Alder reaction with 1,3-butadiene?
 - $\text{CH}_2=\text{CHOCH}_3$
 - $\text{CH}_2=\text{CHCHO}$
 - $\text{CH}_3\text{CH}=\text{CHCH}_3$
 - $(\text{CH}_3)_2\text{C}=\text{CH}_2$
 - $\text{CH}_2=\text{CH}_2$
 - Which of the following is not a fused-ring heterocycle?
 - purine
 - pyrimidine
 - benzofuran
 - indole
 - quinoline
 - In electrophilic aromatic substitution reactions a chlorine substituent:
 - is a deactivator and a *m*-director.
 - is a deactivator and an *o,p*-director.
 - is an activator and a *m*-director.
 - is an activator and an *o,p*-director.
 - none of the above
 - Acetals will react with:
 - LiAlH_4
 - NaOCH_3
 - PhLi
 - $\text{CH}_3\text{CH}_2\text{MgBr}$
 - H_3O^+
 - The Hofmann elimination proceeds via a(n) _____ pathway.
 - E_1
 - E_2
 - Saytzeff
 - $\text{S}_{\text{N}}2$
 - none of the above

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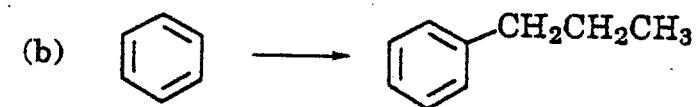
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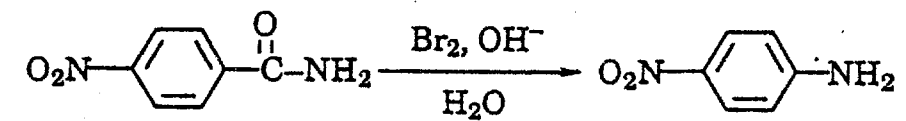
20. An acid which could not be prepared by the reaction of an organic halide with cyanide ion followed by acid hydrolysis of the nitrile is:

- A. propanoic acid
- B. phenylacetic acid
- C. acetic acid
- D. $(\text{CH}_3)_3\text{CCO}_2\text{H}$
- E. $\text{CH}_3(\text{CH}_2)_{14}\text{CO}_2\text{H}$

II. Syntheses (5% of each) (10%)

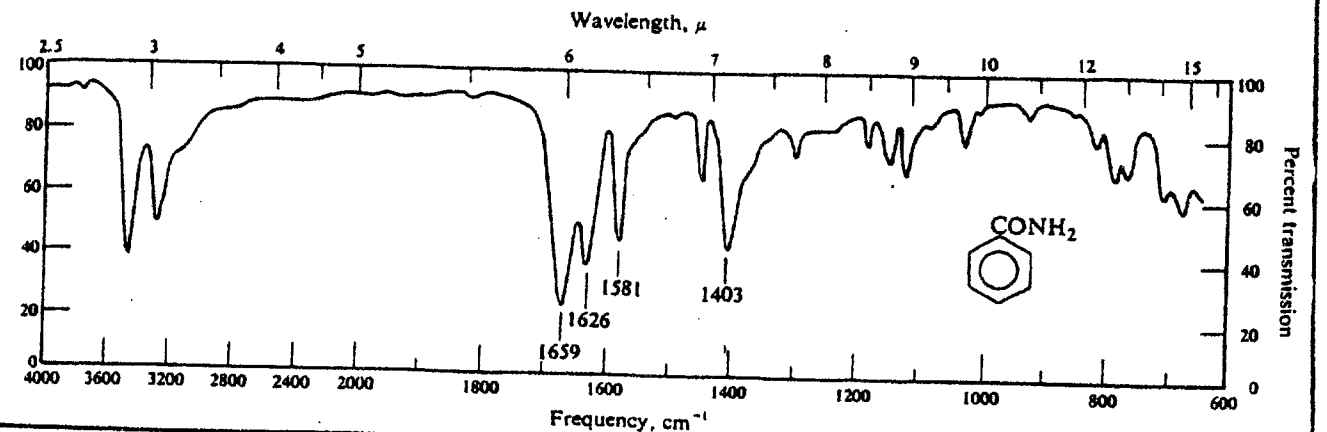


III. Mechanism (5%)



IV. Infrared spectrum (7%)

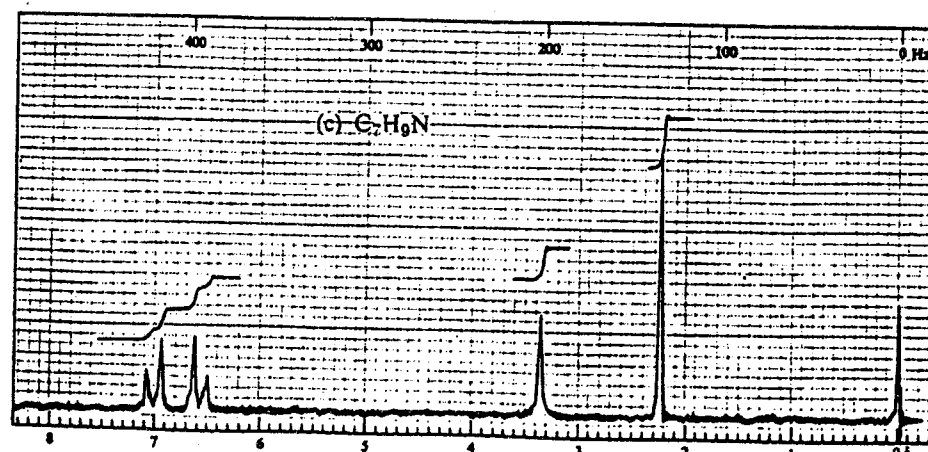
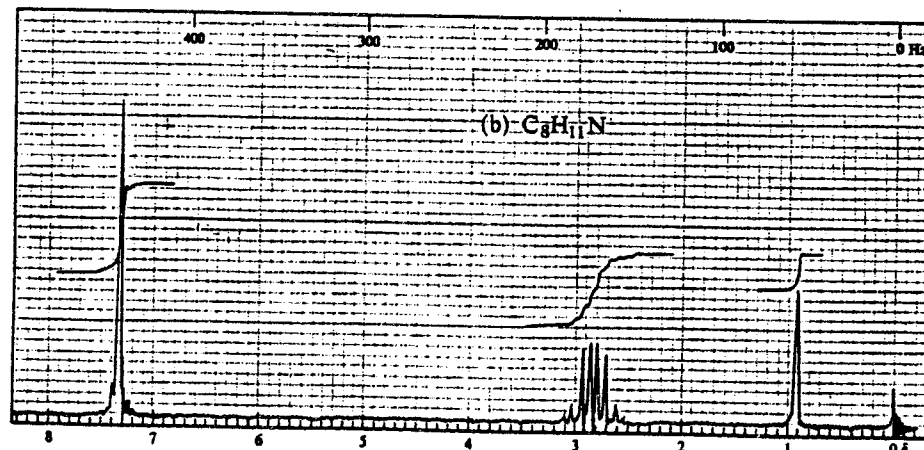
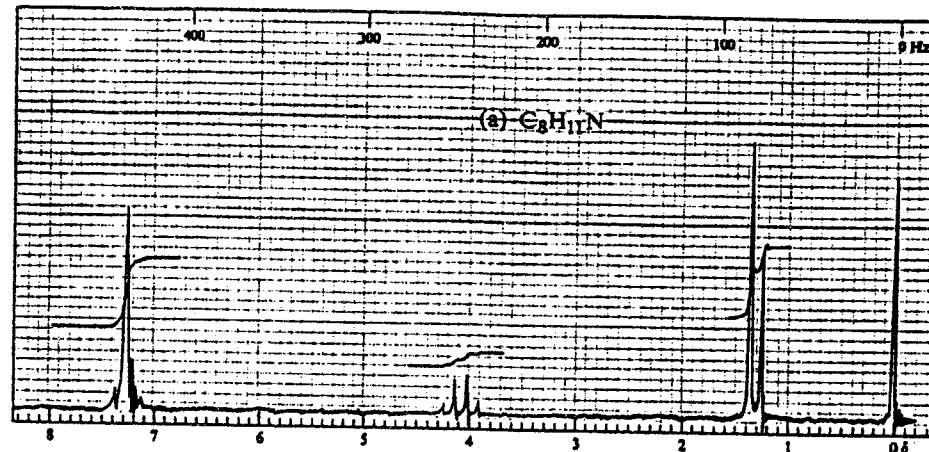
Identify the absorption peaks of benzamide and explain.



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V. NMR spectra (6% of each)

Give a structure or structures consistent with each of the nmr spectra shown below.



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